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(71) Applicant: 000006747

15 Ricoh Company, Ltd.
3-6, Nakamagome 1-chome, Ohta-ku, Tokyo

(72) Inventor: Takashi TSUTSUI
c/o Ricoh Company, Ltd.
3-6, Nakamagome 1-chome, Ohta-ku, Tokyo

20 (72) Inventor: Takashi KANEKO
c/o Ricoh Company, Ltd.
3-6, Nakamagome 1-chome, Ohta-ku, Tokyo

(72) Inventor: Masaki TANAKA
c/o Ricoh Company, Ltd.

25 3-6, Nakamagome 1-chome, Ohta-ku, Tokyo

(74) Agent: Attorney, Gunichiro ARIGA

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(54) [Title of the Invention] LIQUID CRYSTAL DISPLAY ELEMENT

(57) [ABSTRACT]

[OBJECT] The present invention relates to a liquid crystal display element, and it is an object of the present invention to provide a liquid crystal display element in which the colors of a portion where an electrode exists and a portion where the electrode does not exist can be homogenized approximately completely.

[STRUCTURE] In a liquid crystal display element in which a dummy electrode group 2 is disposed in a region other than a region where an original electrode group 1 including a segment electrode and a common electrode which contributes to display is formed, the dummy electrode group 2 is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group 1 positioned in the periphery or vicinity of the dummy electrode group 2.

[Scope of Claims]

[Claim 1]

A liquid crystal display element in which a dummy electrode group (2) is disposed in a region other than a region where an original electrode group (1) including a segment electrode and a common electrode which contributes to display is formed, characterized in that the dummy electrode group (2) is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group (1) positioned in a periphery or vicinity of the dummy electrode group (2).

[Claim 2]

A liquid crystal display element in which a dummy electrode group (12) is disposed in a region other than a region where an original electrode group (1) including a segment electrode and a common electrode which contributes to display is formed, characterized in that the dummy electrode group (12) is patterned so that an aperture ratio, which is a ratio of an actual area of a patterned electrode to an area of the dummy electrode group portion, is the same as or corresponds approximately to an aperture ratio of the electrode group (11) positioned in a periphery or vicinity of the dummy electrode group (12).

[Detailed Description of the Invention]

[0001]

[Industrial Field]

5 The present invention relates to a liquid crystal display element and particularly to a liquid crystal display element in which the colors of a portion where an electrode exists and a portion where the electrode does not exist can be homogenized approximately completely.

[0002]

[Prior Art]

10 A conventional liquid crystal display element is reported in Japanese Published Patent Application Laid-Open No. S58-34488, for example. The liquid crystal display element here is a liquid crystal display element which displays letters, symbols, or graphics by oppositely arranging flexible polymer film substrates inside which thin film electrodes such as a segment electrode, a common electrode, and a lead electrode are
15 provided and enclosing a liquid crystal between the both substrates, wherein a dummy electrode group is provided in a region other than the segment electrode, the common electrode, and the lead electrode inside the flexible polymer film substrate.

[0003]

20 Another conventional liquid crystal display element is reported in Japanese Published Patent Application Laid-Open No. S63-266427, for example. The liquid crystal display element here is a dot matrix electrode structure type liquid crystal display element formed by forming display electrodes respectively on opposing surfaces of opposing two plastic film substrates, sealing a circumference portion with the substrates set apart and opposed, and enclosing a liquid crystal within a space between
25 the substrates, wherein a dummy electrode group to which a signal voltage is not applied is formed on the opposing surface of the substrate of a liquid crystal enclosure portion in a periphery of the display electrode.

[0004]

30 The above conventional liquid crystal display elements have a dummy electrode group 32 provided simply in a portion other than an electrode 31 which

contributes to display as shown in FIG. 3, thereby having an advantage that the color unevenness and the decrease of the contrast in a display portion and a portion other than that can be prevented.

[0005]

5 [Problems to be Solved by the Invention]

The above-mentioned conventional liquid crystal display elements have a structure in which the dummy electrode group 32 is provided simply in the portion other than the electrode 31 which contributes to display. The main object of the dummy electrode group 32 here is to improve the visual quality by eliminating the difference of
10 the colors of the portion where the electrode exists and the portion where the electrode does not exist so as to homogenize the background. As reasons for this difference in the colors, the followings are given.

① It is in a case where a cell gap, that is, the difference of the thickness of a liquid crystal layer appears because of the step due to the thickness of the electrode. Since
15 the thickness of the electrode increases as the required resistance value is lowered, this problem becomes more significant with a larger size and higher duty in which the low resistance is required.

[0006]

Moreover, this problem becomes notable with a panel in a mode of using an
20 ECB effect such as an STN panel because the color sensitively changes particularly due to the fluctuation of the cell gap.

② It is in a case where the light transmittance and the transmission spectrum surely differ in the portion where the electrode exists and the portion where the electrode does not exist because the electrode itself absorbs light. Since the electrode having lower
25 resistance tends to have lower transmittance, the problem also becomes more significant with a panel of a larger size and higher duty. Meanwhile, in a *ganfu*[?] panel, the problem results from the combination of the above ① and ②. On the other hand, in a panel using a plastic substrate (hereinafter PF-LCD), moreover, the following factors are given.

30 ③ In order to make an ITO electrode over a plastic substrate low-resistant, there is no

other way but to depend on means of increasing the film thickness because the heating temperature for the substrate at the formation of ITO is limited. For example, the film thickness becomes 2000 Å or more to obtain 20 O/□. Consequently, the above problems of ① and ② are promoted further.

- 5 ④ Portions where the electrode exists and the electrode does not exist at a film substrate slightly differ in the ratio of expansion and contraction due to heat and the ratio of expansion and contraction due to moisture absorption and water absorption; therefore, uniform cell gap is not obtained because the substrate itself is distorted in the manufacturing process. Thus, in the PF-LCD, the color is different due to the
 10 combination of the above ① to ④. In particular, the problem becomes the most notable and significant in a STN PF-LCD of a large size and high duty or the like.

[0007]

- When these adverse conditions coincide, the above defect cannot be eliminated sufficiently and the color cannot be homogenized completely only by simply providing
 15 the dummy electrode group 32 all over as the above-mentioned conventional liquid crystal display elements. Because the electrode 31 for display has microscopic patterns with various shapes, pitches, and directions formed in accordance with the operation of each portion (for example, a portion which displays by lighting and a portion for drawing wirings) and the microscopic cell gap formed by these pattern group
 20 and a spatial fluctuation pattern of the transmittance are recognized as a spatial fluctuation pattern of the tone of color and the brightness, which is felt as the color as a whole.

[0008]

- Consequently, it is an object of the present invention to provide a liquid crystal
 25 display element in which the colors of a portion where an electrode exists and a portion where the electrode does not exist can be homogenized approximately completely.

[0009]

[Means for Solving the Problems]

- The liquid crystal display element described in Claim 1 is a liquid crystal
 30 display element in which a dummy electrode group is disposed in a region other than a

region where an original electrode group including a segment electrode and a common electrode which contributes to display is formed, wherein the dummy electrode group is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group positioned in a periphery or vicinity of the dummy electrode group.

[0010]

The invention described in Claim 2 is a liquid crystal display element in which a dummy electrode group is disposed in a region other than a region where an original electrode group including a segment electrode and a common electrode which contributes to display is formed, wherein the dummy electrode group is patterned so that an aperture ratio, which is a ratio of an actual area of a patterned electrode to an area of the dummy electrode group portion, is the same as or corresponds approximately to an aperture ratio of the electrode group positioned in a periphery or vicinity of the dummy electrode group.

[0011]

[Operation]

According to the present invention described in Claim 1, a dummy electrode group is disposed in a region other than a region where an original electrode group including a segment electrode and a common electrode which contributes to display is formed, and the dummy electrode group is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group positioned in a periphery or vicinity of the dummy electrode group. Therefore, the microscopic cell gap formed by the dummy electrode group and the original electrode group in the periphery or vicinity of the dummy electrode group and the spatial fluctuation pattern of the transmittance can be corresponded approximately completely. For this reason, the spatial fluctuation pattern (spatial frequency) of the tone of color and the brightness can be corresponded and the color of the appearance can be homogenized approximately completely.

[0012]

According to the invention described in Claim 2, a dummy electrode group is

disposed in a region other than a region where an original electrode group including a segment electrode and a common electrode which contributes to display is formed, and the dummy electrode group is patterned so that an aperture ratio, which is a ratio of an actual area of a patterned electrode to an area of the dummy electrode group portion, is the same as or corresponds approximately to an aperture ratio of the electrode group positioned in a periphery or vicinity of the dummy electrode group. Therefore, when the original electrode group in the periphery is complicated or various pattern shapes are combined so that distinctive shape and pitch direction are difficult to extract (when the pattern design of the dummy electrode group is difficult), a simpler pattern (may be a fixed pattern such as stripes) is just formed so that the aperture ratios are corresponded. Consequently, approximately the same effect as the invention described in Claim 1 can be easily obtained.

[0013]

[Embodiment]

The present invention is hereinafter described with reference to the drawings.
(Embodiment 1)

FIG 1 is a schematic view showing a structure of a liquid crystal display element based on Embodiment 1 of the present invention. In FIG. 1, 1 denotes an original electrode group including a segment electrode (signal electrode) and a common electrode (scanning electrode) which contributes to display and 2 denotes a dummy electrode group disposed in a region other than a region where this electrode group 1 is formed. This dummy electrode group 2 is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group 1 positioned in the periphery or vicinity of the dummy electrode group 2.

[0014]

Thus, in this embodiment, the dummy electrode group 2 is disposed in the region other than the region where the original electrode group 1 including the segment electrode and the common electrode which contributes to display is formed, and the dummy electrode group 2 is patterned so as to be the same as or correspond approximately to a pattern shape, pitch, and a direction of the electrode group 1 in the

periphery or vicinity of the dummy electrode group 2 as shown in FIG. 1(a) to (c). Therefore, the microscopic cell gap formed by the dummy electrode group 2 and the original electrode group 1 in the periphery or vicinity of the dummy electrode group 2 and the spatial fluctuation pattern of the transmittance can be corresponded
5 approximately completely. For this reason, the spatial fluctuation pattern (spatial frequency) of the tone of color and the brightness can be corresponded and the color of the appearance can be homogenized approximately completely.

(Embodiment 2)

FIG. 2 is a schematic view showing a structure of a liquid crystal display
10 element based on Embodiment 2 of the present invention. In FIG. 2, 11 denotes an original electrode group including a segment electrode and a common electrode which contributes to display and 12 denotes a dummy electrode group disposed in a region other than a region where the electrode group 11 is formed. This dummy electrode group 12 is patterned so that an aperture ratio, which is a ratio of an actual area of a
15 patterned electrode to an area of the dummy electrode group portion, is the same as or corresponds approximately to an aperture ratio of the electrode group 11 positioned in a periphery or vicinity of the dummy electrode group 12.

[0015]

Thus, in this embodiment, the dummy electrode group 12 is disposed in the
20 region other than the region where the original electrode group 11 which contributes to display is formed, and the dummy electrode group 12 is patterned so that an aperture ratio, which is a ratio of an actual area of a patterned electrode to an area of the dummy electrode group portion, is the same as or corresponds approximately to an aperture ratio of the electrode group 11 positioned in a periphery or vicinity of the dummy electrode
25 group 12. Therefore, when the original electrode group 11 in the periphery is complicated or various pattern shapes are combined so that distinctive shape and pitch direction are difficult to extract (when the pattern design of the dummy electrode group is difficult), a simpler pattern (may be a fixed pattern such as stripes) is just formed so that the aperture ratios are corresponded. Consequently, approximately the same effect
30 as Embodiment 1 can be easily obtained.

[0016]

[Effect of the Invention]

According to the present invention, there is an effect that the color appearing in the portion where the electrode exists and the portion where the electrode does not exist
5 can be homogenized approximately completely.

[Brief Description of the Drawings]

[FIG. 1] A schematic view showing a structure of a liquid crystal display element based on Embodiment 1 according to the present invention.

10 [FIG. 2] A schematic view showing a structure of a liquid crystal display element based on Embodiment 2 according to the present invention.

[FIG. 3] A schematic view showing a structure of a liquid crystal display element of a conventional example.

[Description of Reference Numerals and Signs]

15 *1, 11 electrode group
2, 12 dummy electrode group

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20 (72) Inventor: Tomomi SUETAKE
c/o Ricoh Company, Ltd.
3-6, Nakamagome 1-chome, Ohta-ku, Tokyo